AmeriFlux Data Manager's Workshop
LBNL, Berkeley, CA
Feb. 12-13, 2014

Thirteen years flux observations at Tonzi (US-Ton) and Vaira (US-Var)

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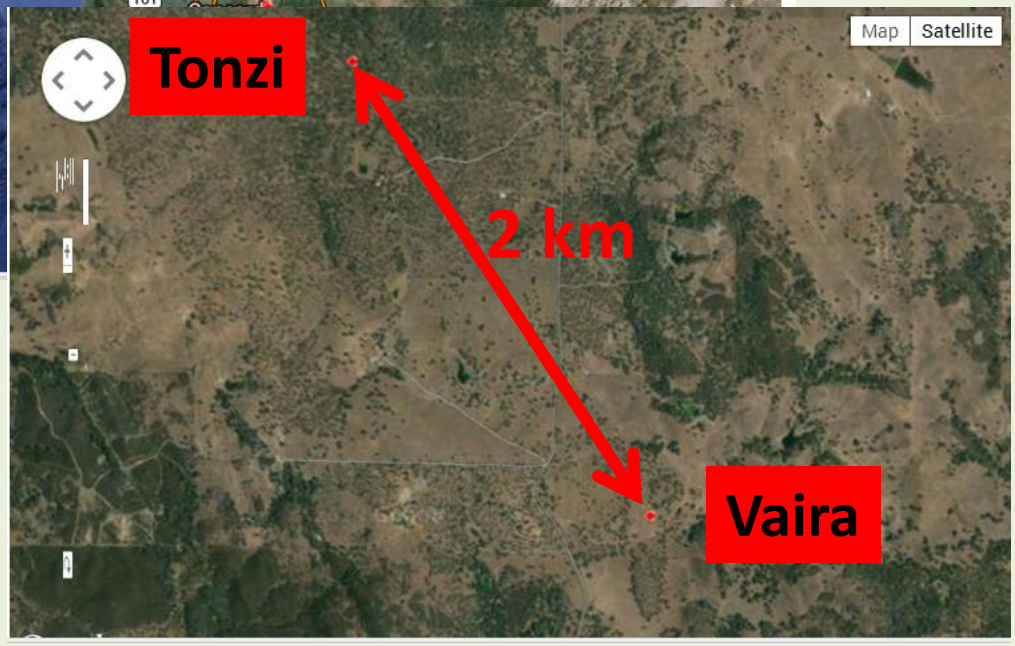


- Foothills of Sierra-Nevada Mountains
- Woody savanna & annual grassland

How do Tonzi and Vaira Ranch look?

Tonzi Ranch: US-Ton

- **more trees**
- **open canopy**

Vaira Ranch: US-Var

- **open grassland**
- **annual C3 grasses**

- **Seasonality:**
  - **Wet, mild winter & spring**
  - **Dry, hot summer & fall**
- **Phenology:**
  - **Oak trees: leaf-out at the end of March; grow in the spring; maintain in the dry summer; deciduous in the fall and winter.**
  - **Annual grasses: germinate in Oct.-Nov.; die-out around May.**
- **Disturbances:**
  - **Yearly summer drought**
  - **Extreme dry years: 2004, 2007, 2008, 2013**
  - **Grazing land: ~20 cows per acre**

Research Goal:

to understand CO_2/H_2O cycling in this savanna ecosystem from different perspectives

To understand our elephant, we work together as a team.

Questions of this talk

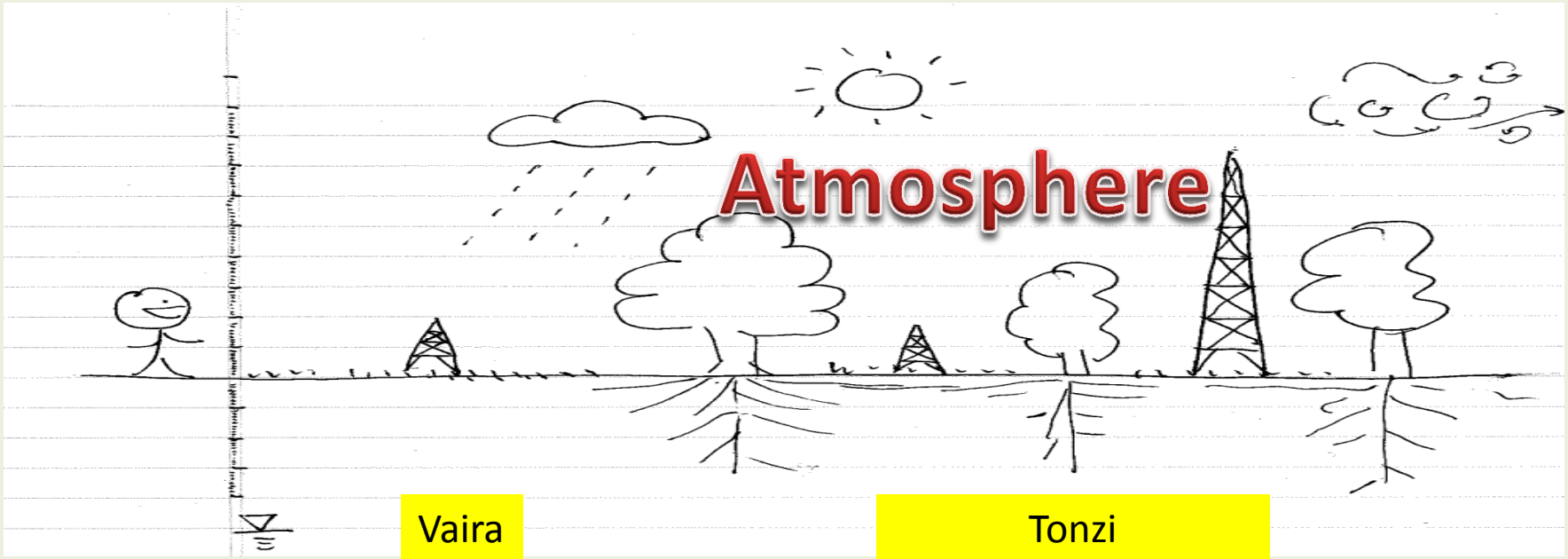
1. **What did we measure in the past 13 years (Oct. 2000 – now)?**

2. **What are problems and challenges we experience in data processing?**

3. **What can be improved by cooperating with you – AmeriFlux Team?**

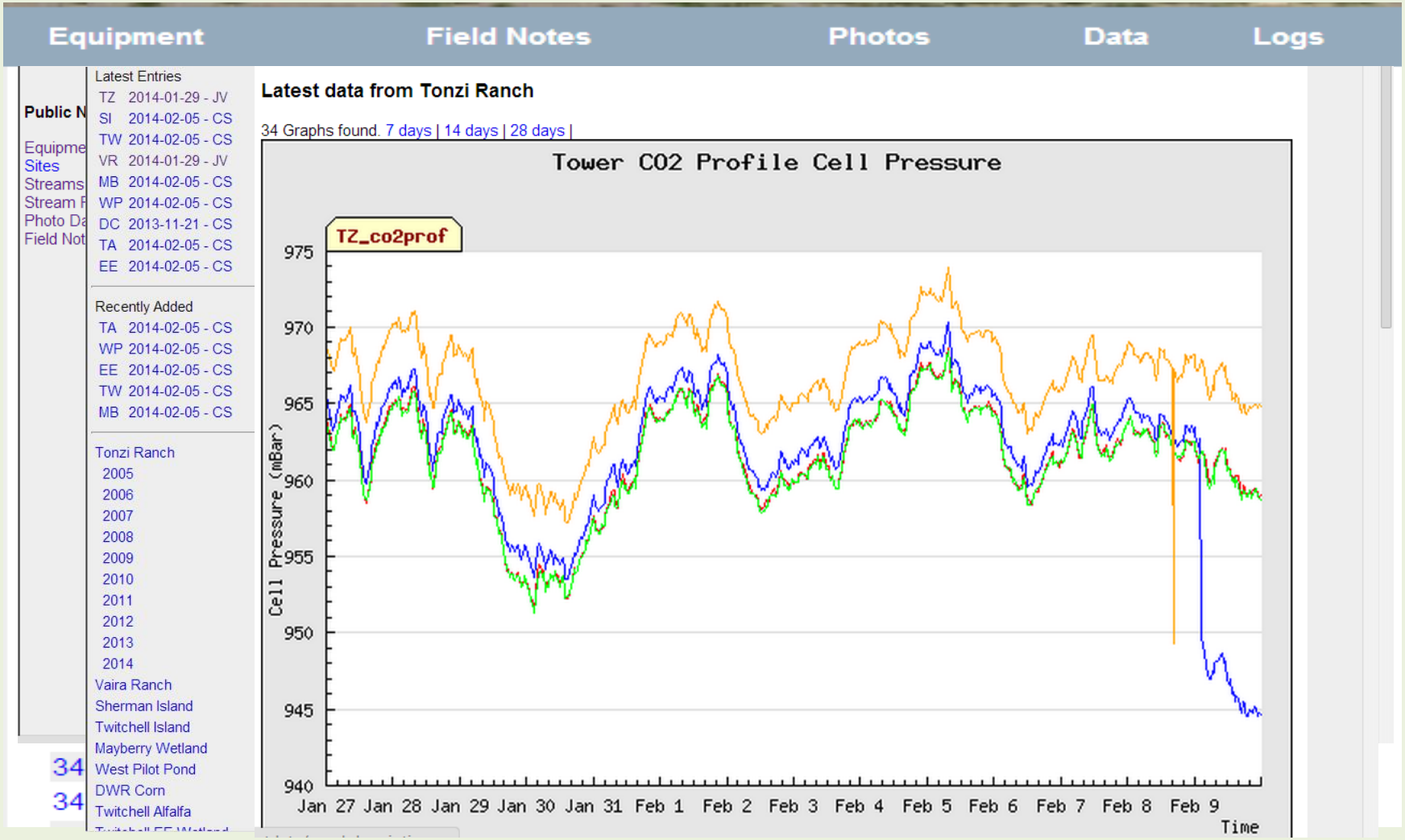
1. What did we measure in the past 13 years?

Essential Flux/Met Observations



- Eddy Covariance systems: 2+1=3 towers
- Basic met at the tower: Ta, rh, Pa, precipitation
- Radiations: PAR, Rn, SW, LW, diffusive
- Light spectrums with LED sensors

Status of all sensors are tracked and recorded in the online database of Biomet Lab



http://nature.berkeley.edu/biometlab/bmetdata/

(Talk to Joe Verfaillie for more details: jverfail@berkeley.edu)

Plant/Vegetation Data

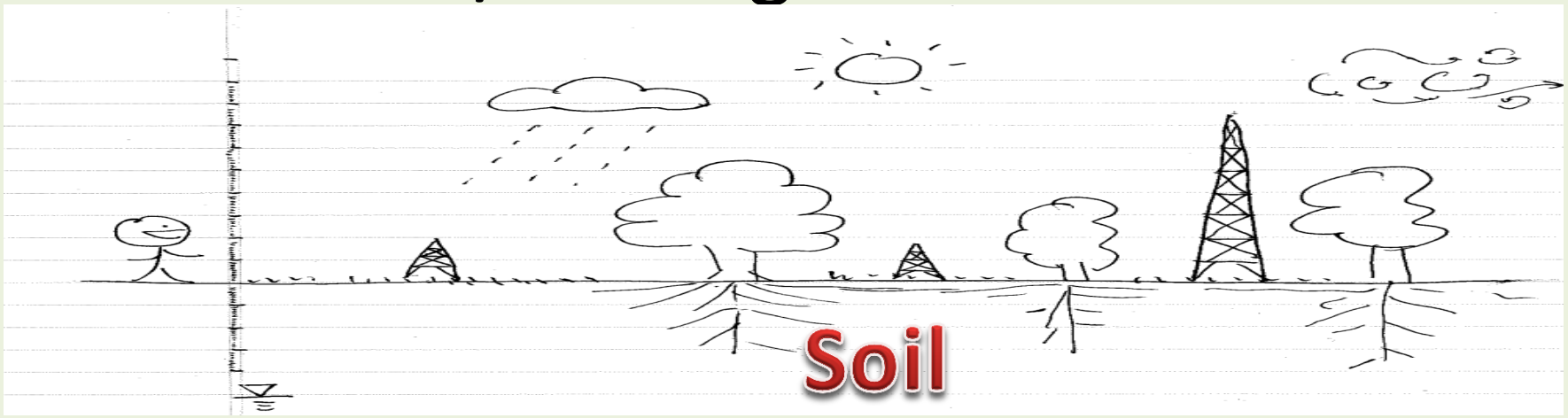
Grasses:

1. LAI
2. aboveground dry weight
3. Above-ground biomass at the end of season
4. Phenology: field observation; Pheno-cam,daily
5. Species composition
6. Spectral reflectance

Oak Trees:

1. LAI from LAI-cam
2. Leaf traits: C, N, SPA
3. Leaf-level: Vcmax, jmax, r_s
4. Canopy structure from LIDAR
5. Dendrometers: DBH
6. Phenology: field observation; Pheno-cam,daily
7. Mortality survey
8. Tree root density (fine, coarse)

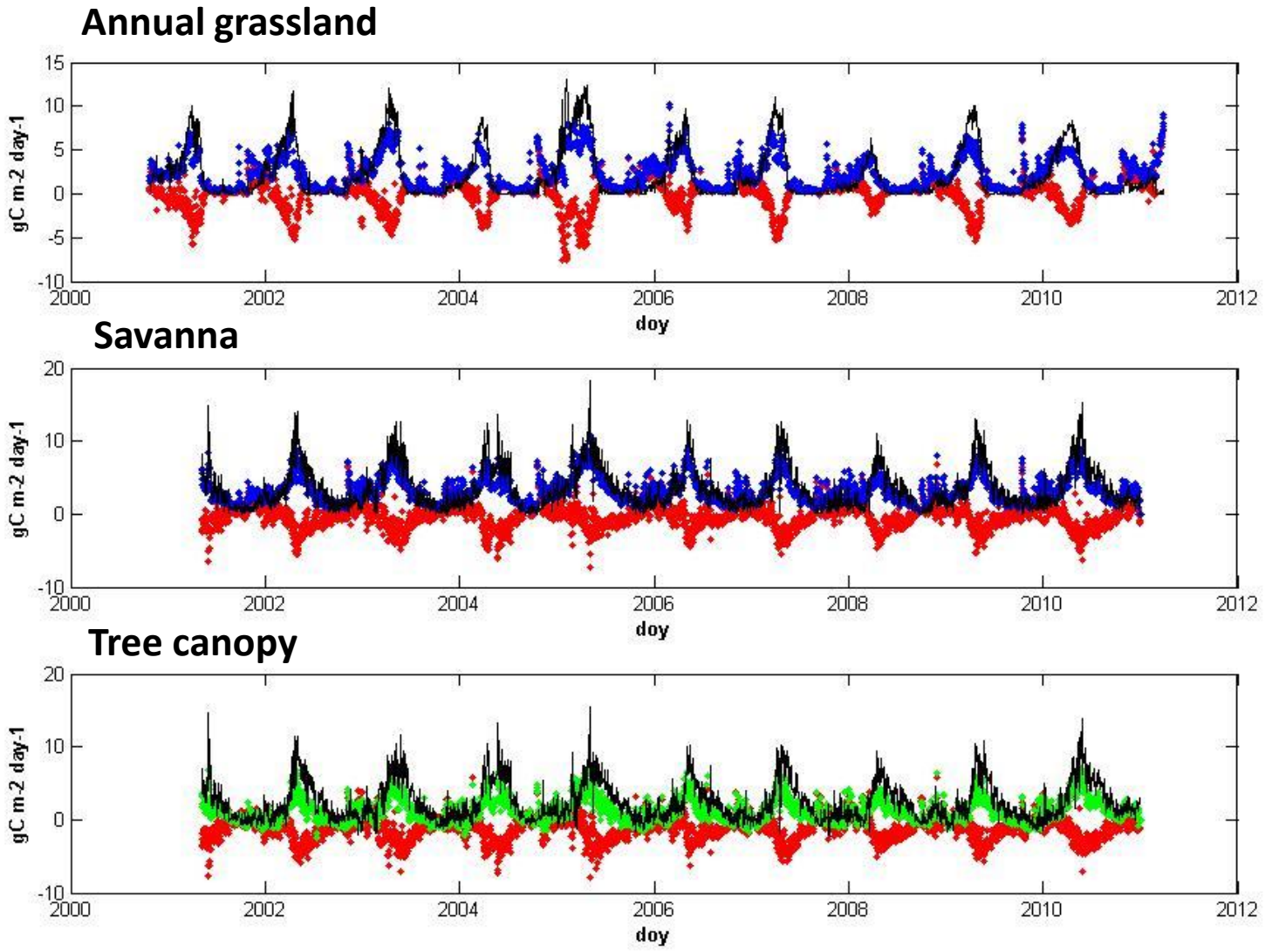
Soil/Belowground Dada



- Soil temperature: 5 depths
- Soil moisture: 3 depths
- Soil moisture probes in soil profile (manually)
- Soil moisture by COMOS
- Soil CO_2 profiles: 3 depths near soil surface
- Soil heat flux profiles: 5 depths
- groundwater data: manually (bi-weekly), automatic sensor (half-hourly)
- Snapshots of soil properties: soil bulk density; Soil water potential curve; total C & N; texture
- Soil depth with EMI

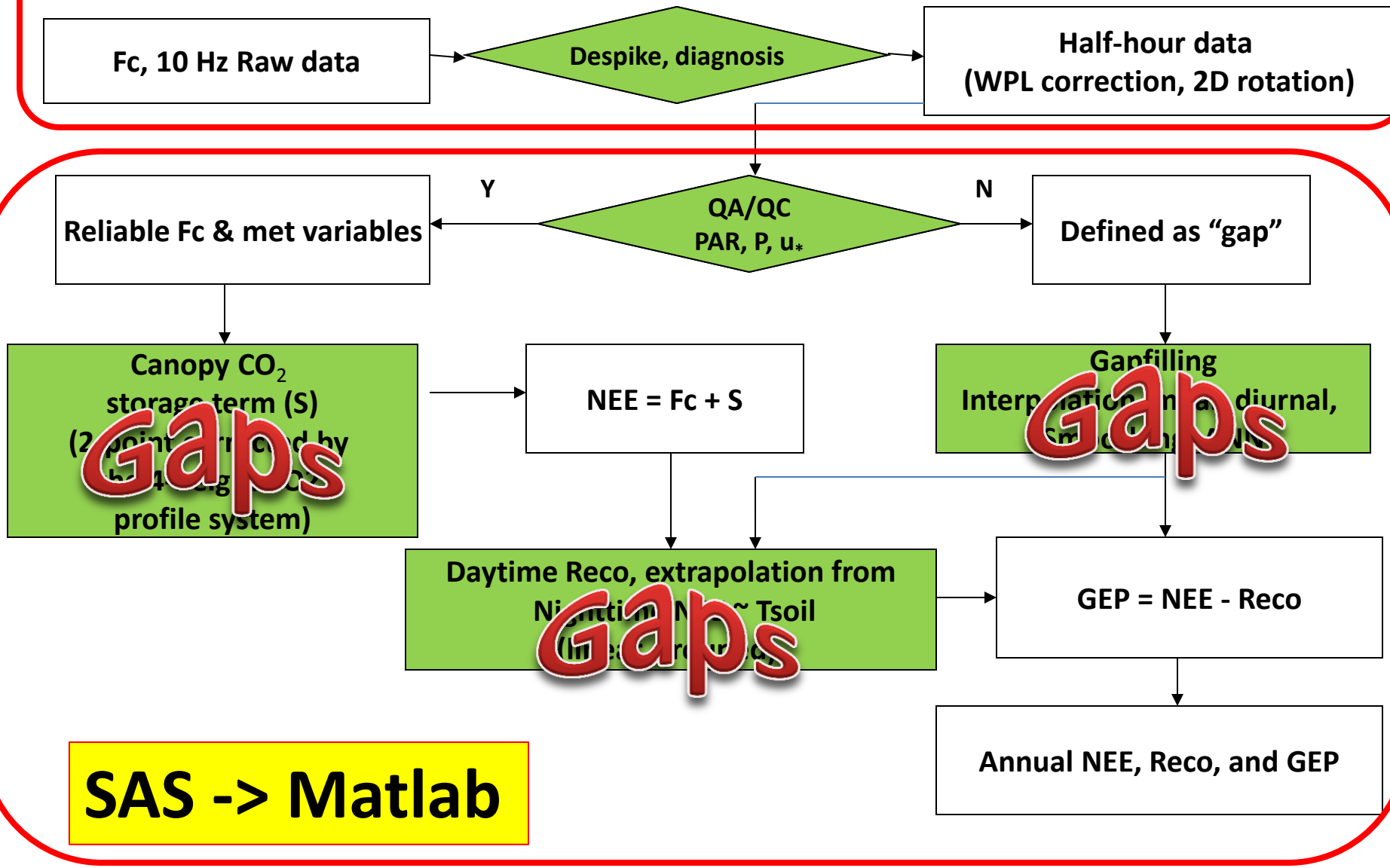
2. What are problems & challenges in our data processing?

GPP, Reco, NEE



Flowchart of Partitioning NEE

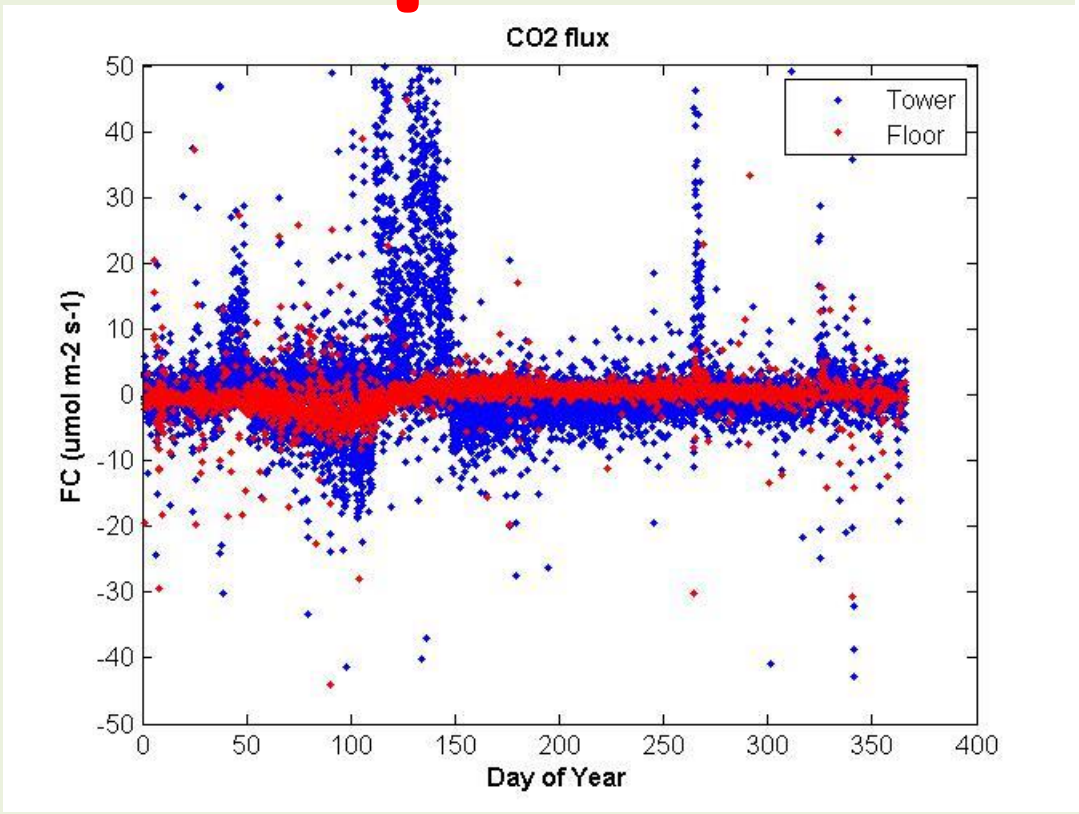
C++ -> Matlab

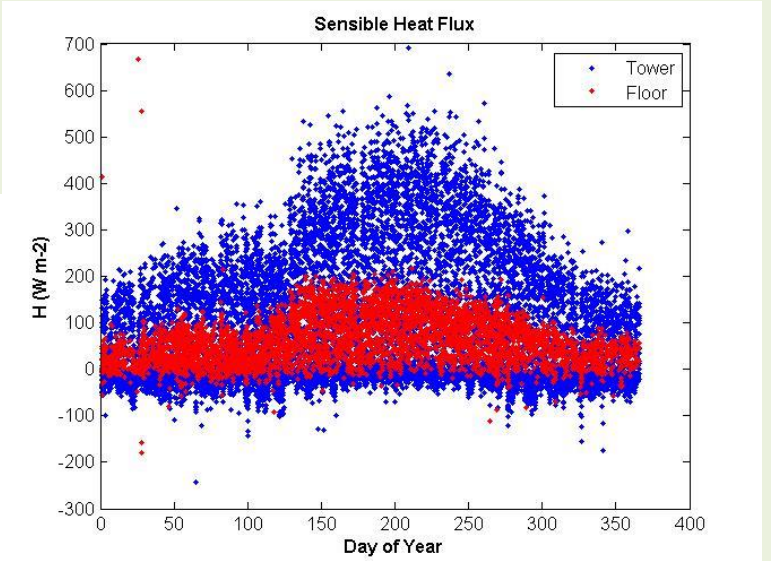


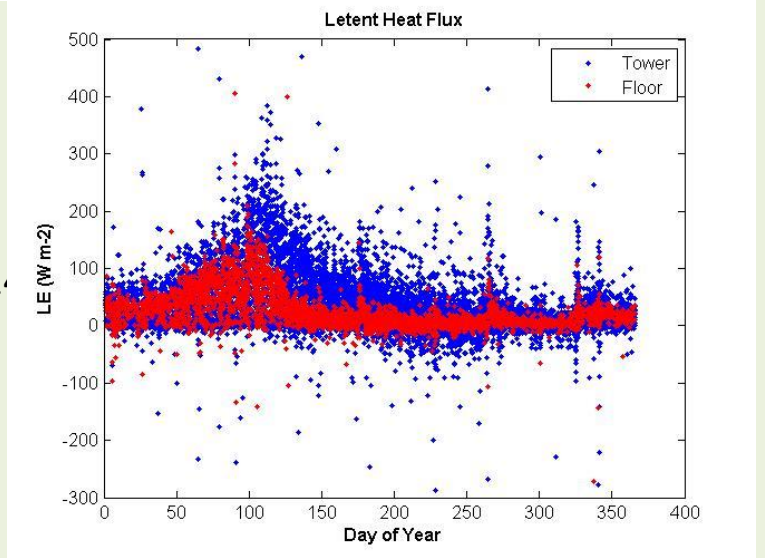
SAS -> Matlab

Tonzi Tower CO2 flux has an unusual period in the spring of 2013.

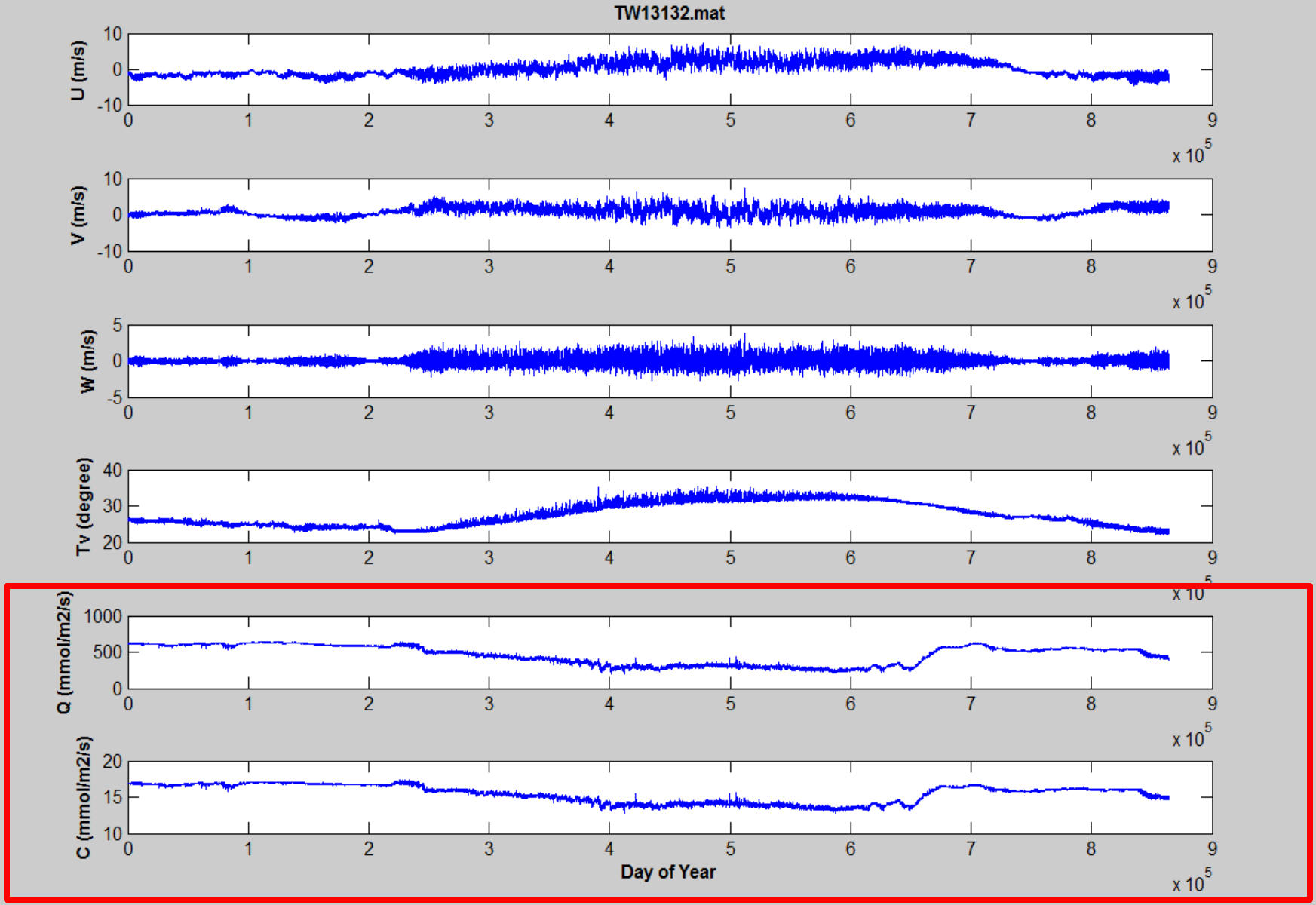
?





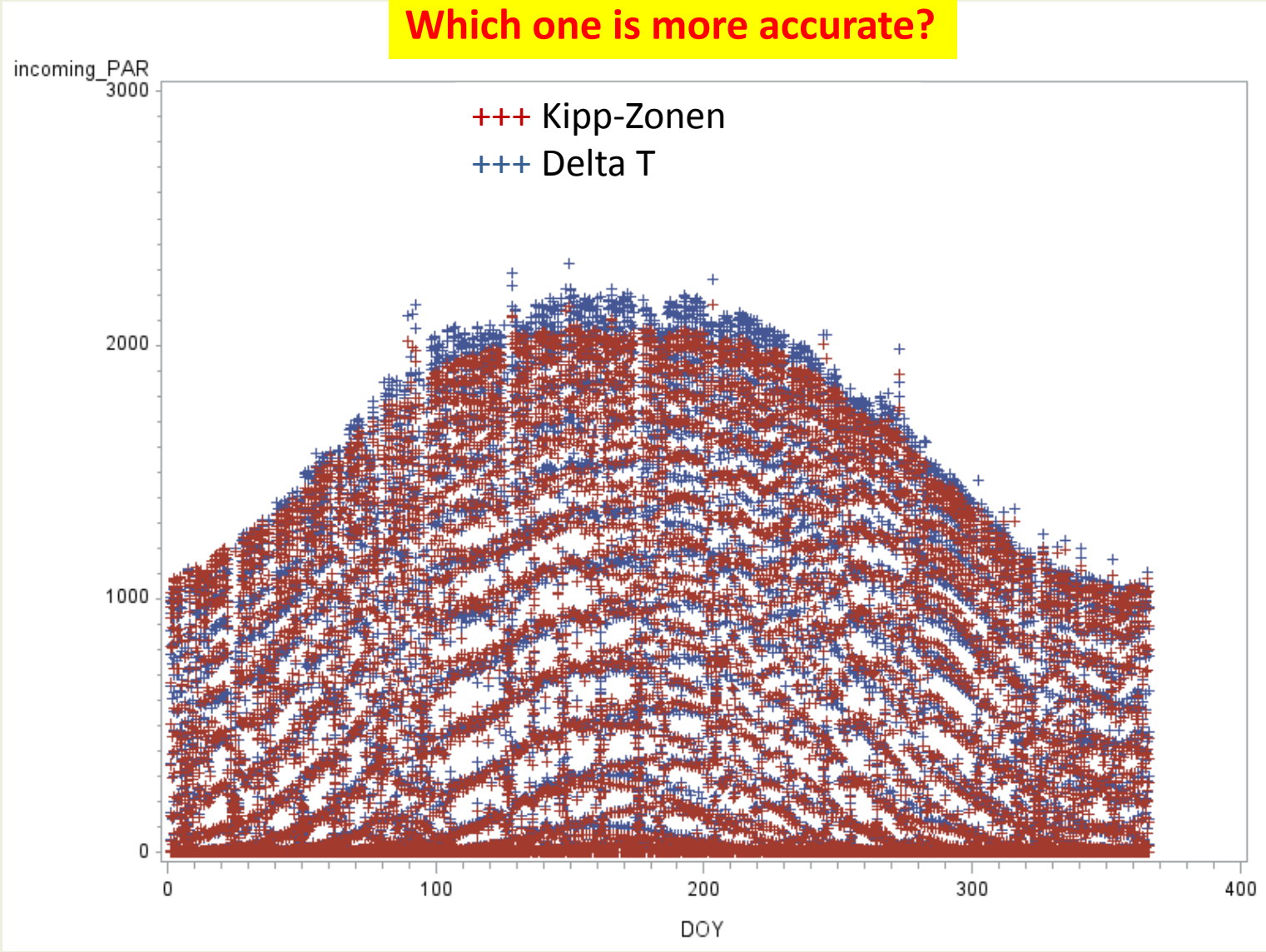


Something wrong? Check daily 10Hz data in Matlab

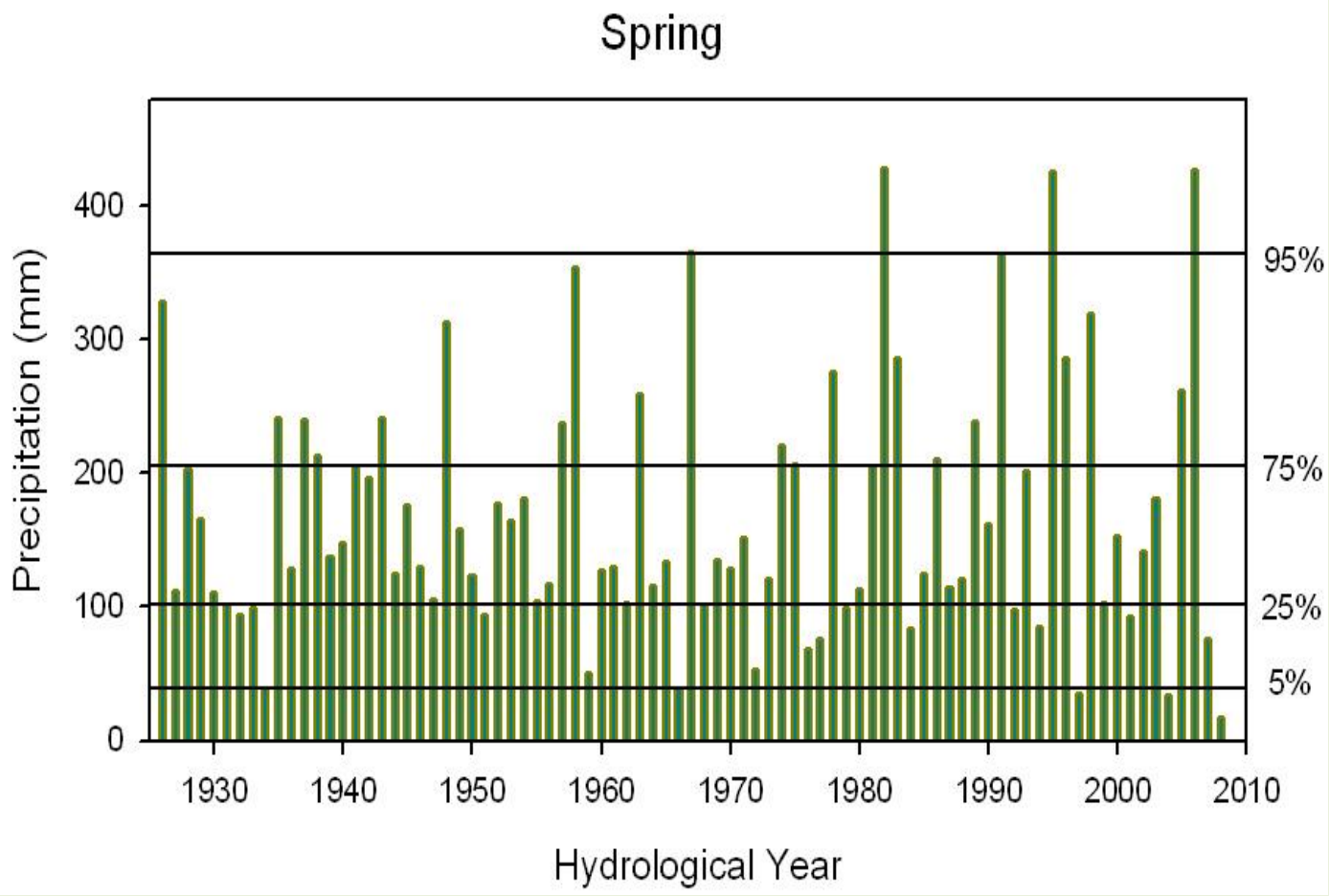


Difference between sensors

Which one is more accurate?

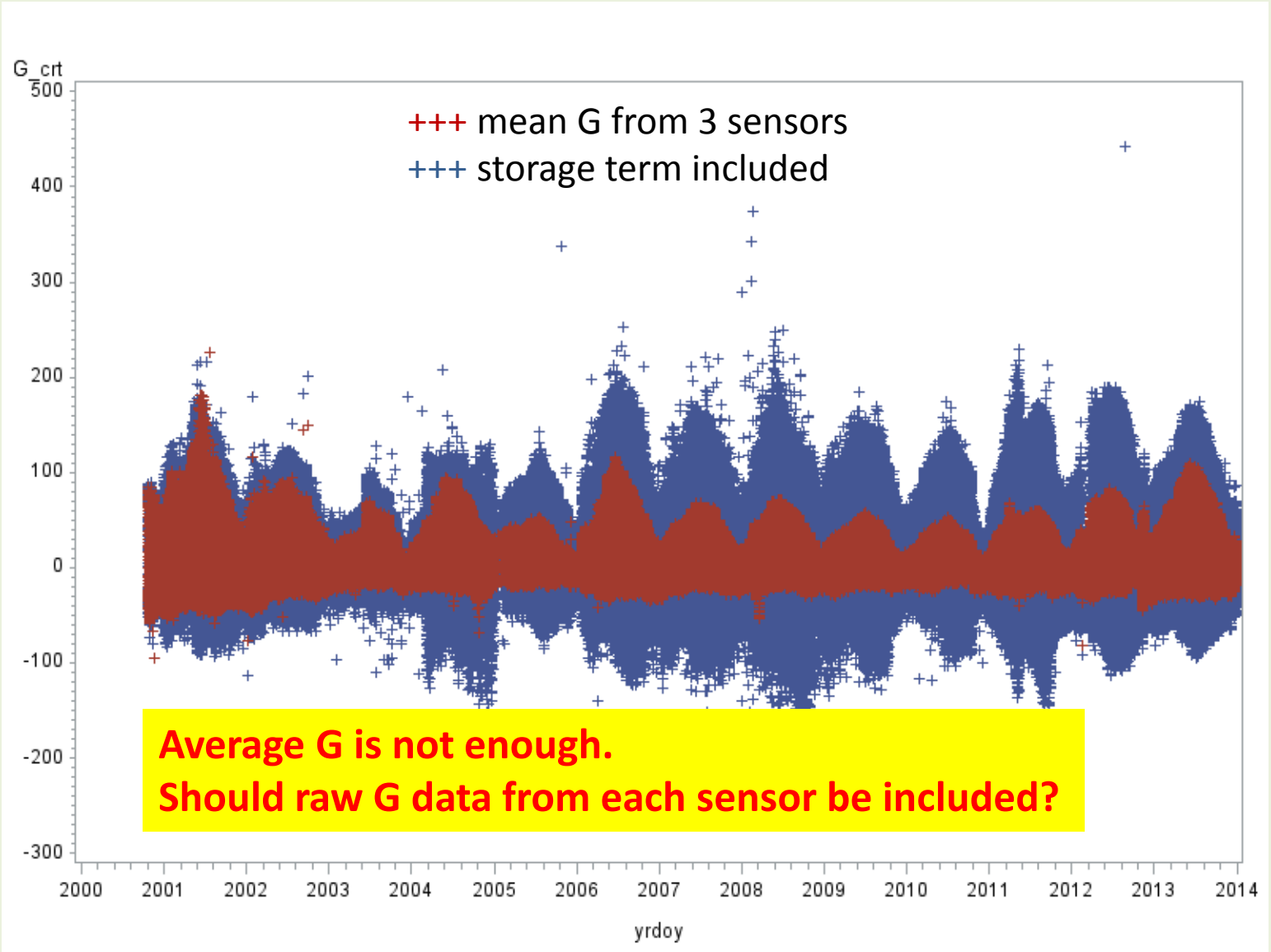


Gap-fill precipitation from nearby long-term weather station



Should AmerFlux include data from the weather station near the tower?

Soil Heat Flux (G): average not enough; records from each sensor



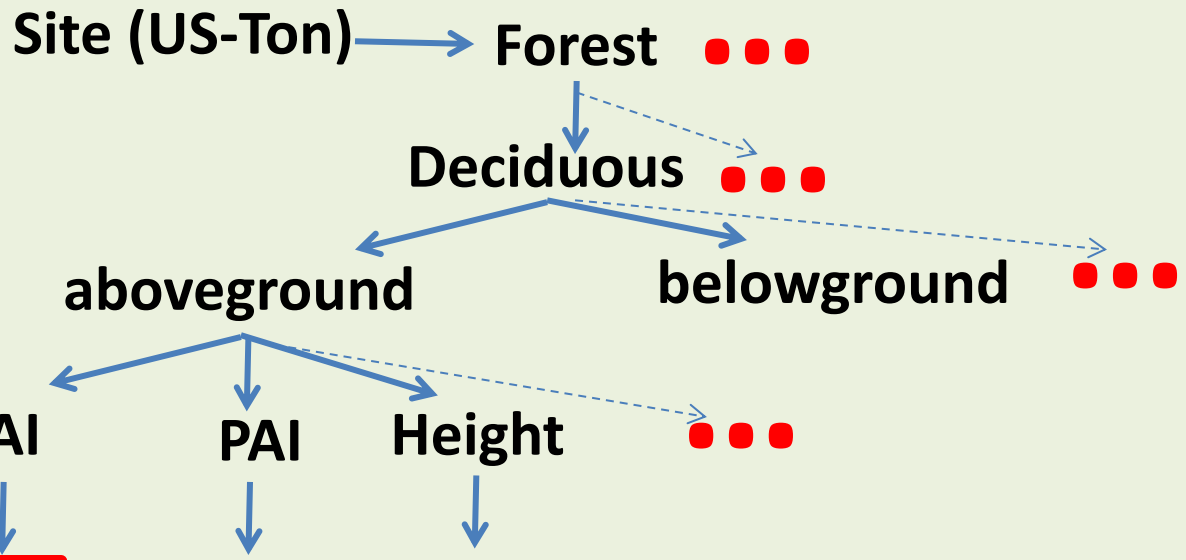
3. What can be improved by cooperating with AmeriFlux Team?

- **Alternative algorithms for despiking, gapfilling, partitionting**
- **Naming system for extra variables:** wc, wq, wt, ubar, vbar, wbar, tbar, cbar, qbar, uu, vv,ww,tt,cc,qq, uv, uw, uv…and variables for BADM database.
- **Online tools: easier data submission, better problem tracking, easier between-site comparison, more flexible mistake correction, more efficient opinion exchange…**

Learning and using BADM variable naming system

LAI_O	LAI_U	PAI	HEIGHTC
LAI_O_SIGMA	LAI_U_SIGMA	PAI_SIGMA	HEIGHTC_SIGMA
LAI_O_UNC	LAI_U_UNC	PAI_UNC	HEIGHTC_UNC
LAI_O_DEC	LAI_TOT	PAI_METHOD	HEIGHTC_U
LAI_O_DEC_SIGMA	LAI_TOT_SIGMA	PAI_DATE	HEIGHTC_U_SIGMA
LAI_O_DEC_UNC	LAI_TOT_UNC	PAI_COMMENT	HEIGHTC_U_UNC
LAI_O_EVG	LAI_CLUMP		HEIGHTC_DATE
LAI_O_EVG_SIGMA	LAI_METHOD		HEIGHTC_COMMENT
LAI_O_EVG_UNC	LAI_DATE		
	LAI_COMMENT		

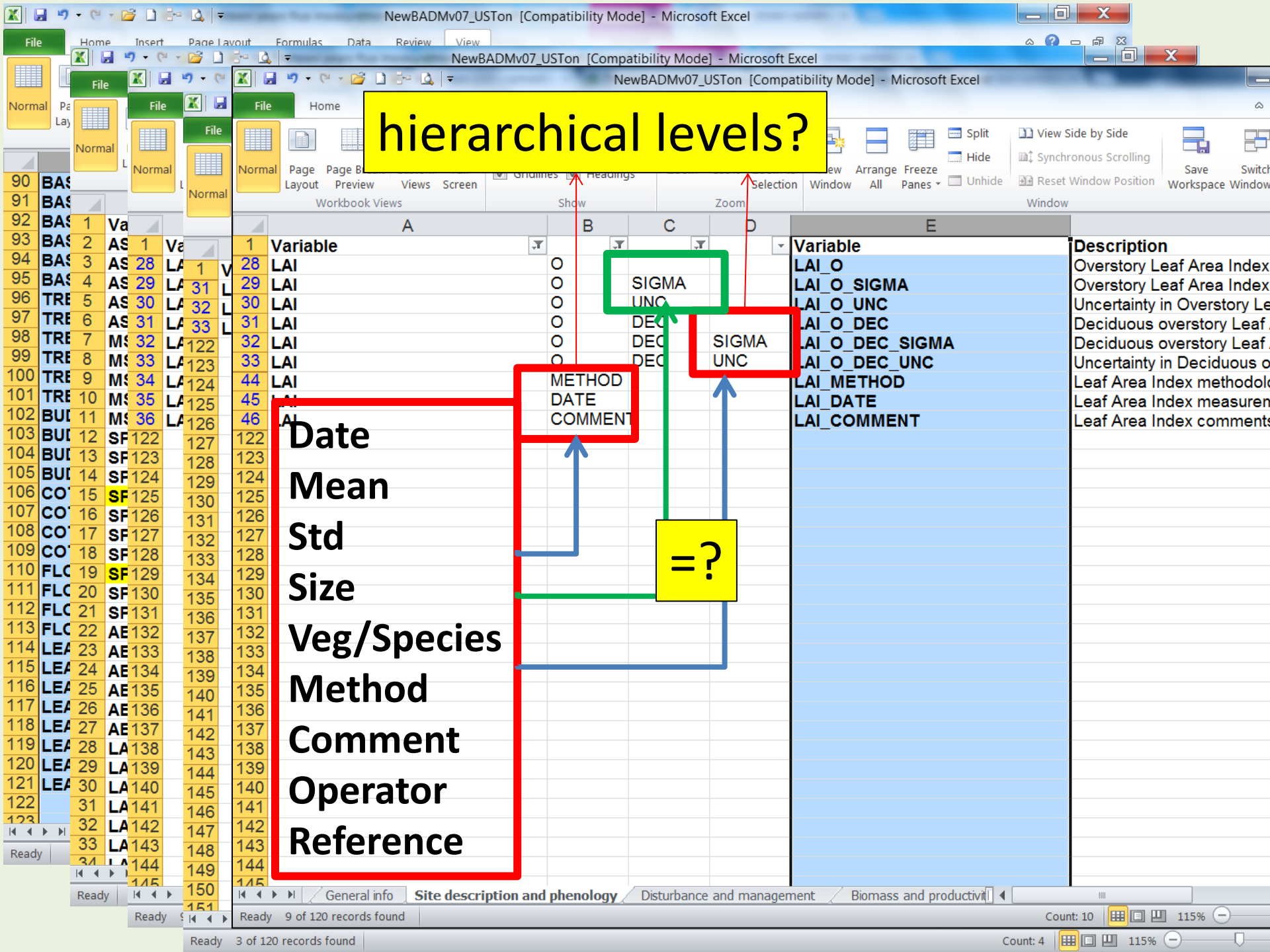
A hierarchy from a data collector;s point of view



- Date
- Mean
- Std
- Size
- Veg/Species
- Method
- Comment
- Operator
- Reference
- ...

Same variables to handle

Open ended


NewBADMv07_USTon [Compatibility Mode] - Microsoft Excel
hierarchical levels?
Variable
LAI
METHOD
DATE
COMMENT
SIGMA
UNC
DEC
Date
Mean
Std
Size
Veg/Species
Method
Comment
Operator
Reference
=?
Variable
Description
LAI_O
LAI_O_SIGMA
LAI_O_UNC
LAI_O_DEC
LAI_O_DEC_SIGMA
LAI_O_DEC_UNC
LAI_METHOD
LAI_DATE
LAI_COMMENT
General info
Site description and phenology
Disturbance and management
Biomass and productivit
Ready
9 of 120 records found
Count: 10
115%
3 of 120 records found
Count: 4

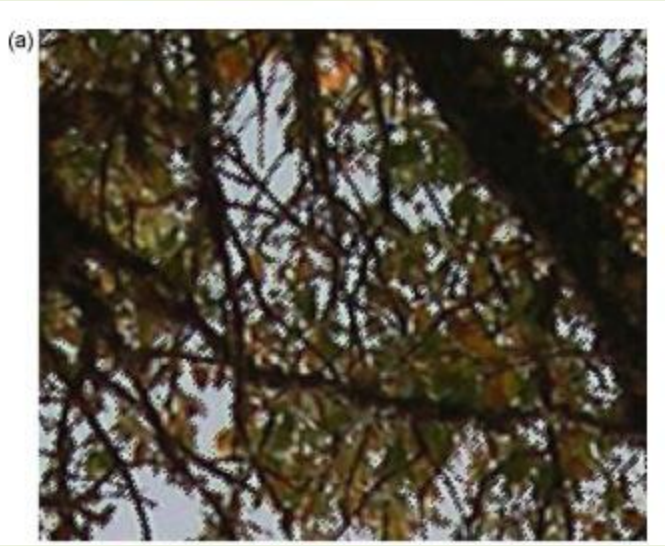
More bio-met observations

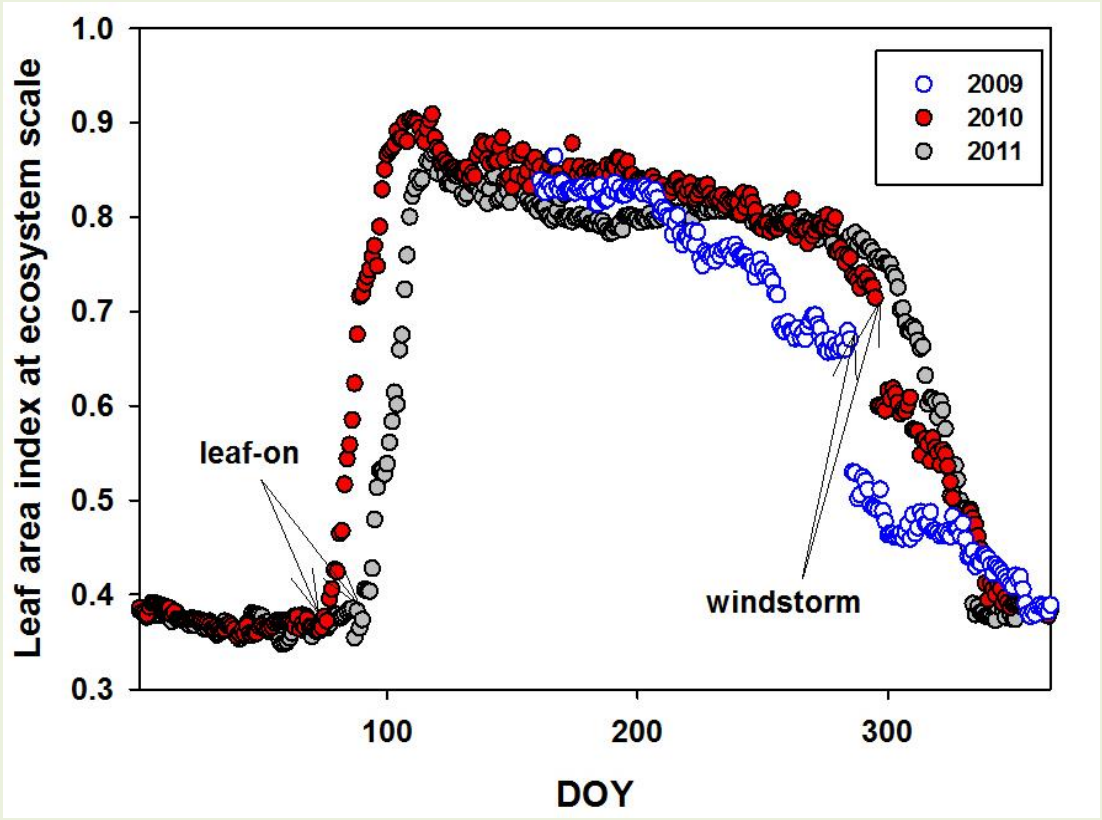
- CO_2 profile: at 4 heights
- Ta&Rh profile: at 4 heights

- Tram data – radiation under tree canopy, including position(x,y), 1Hz

- Boundary-lay height measured with Radiosonde


2009/03/12

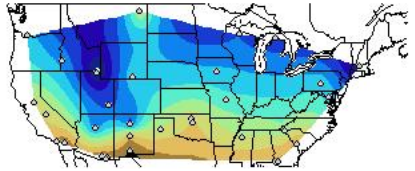

(a)


Leaf area index at ecosystem scale
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
100
200
300
DOY
2009
2010
2011
leaf-on
windstorm

More ecosystem data from cooperators

COSMOS
Cosmic-ray Soil Moisture Observing System

http://cosmos.hwr.arizona.edu/



COSMOS is an NSF supported project to measure soil moisture on the horizontal scale of hectometers and depths of decimeters using cosmic-ray neutrons.

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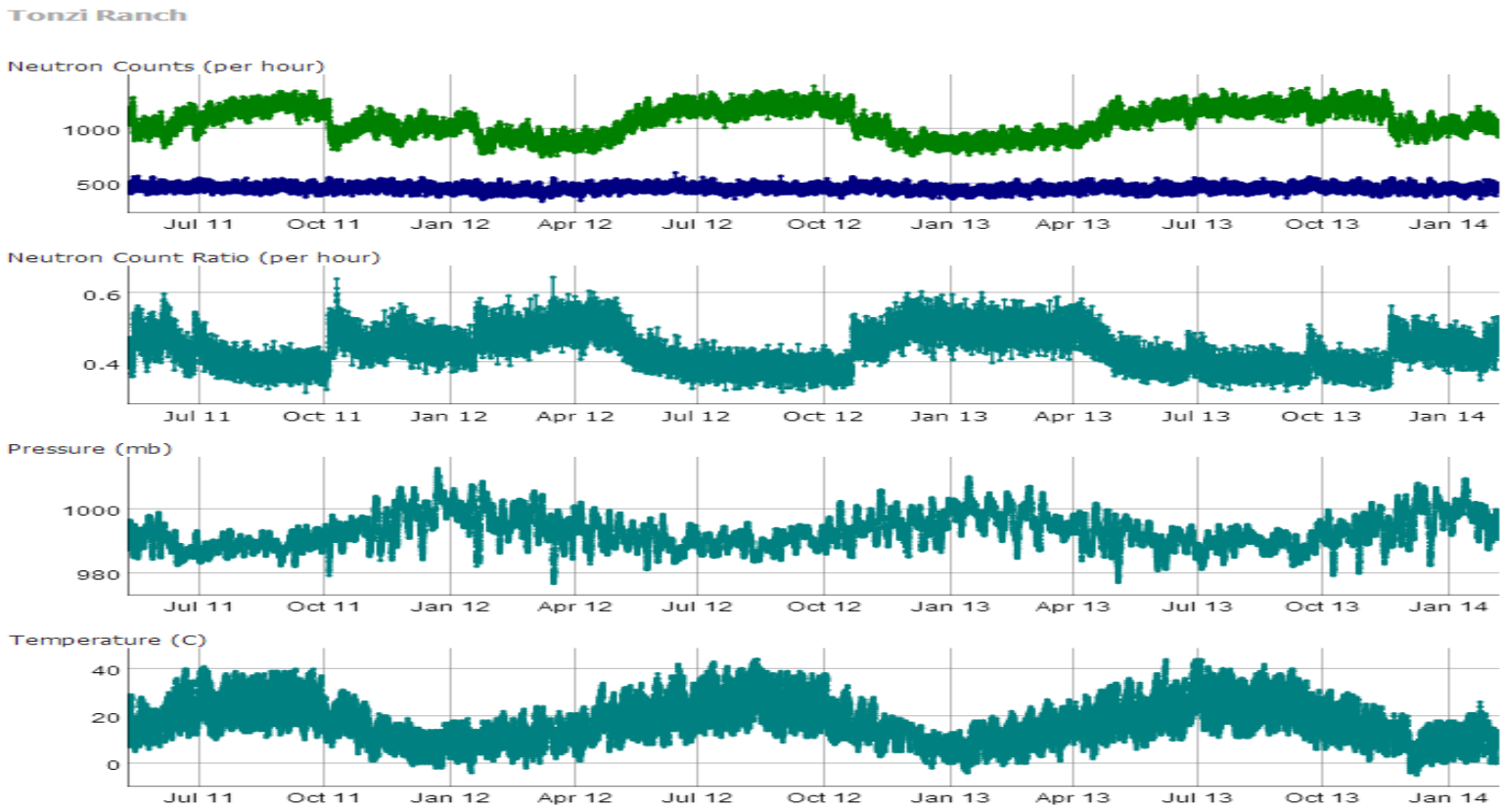
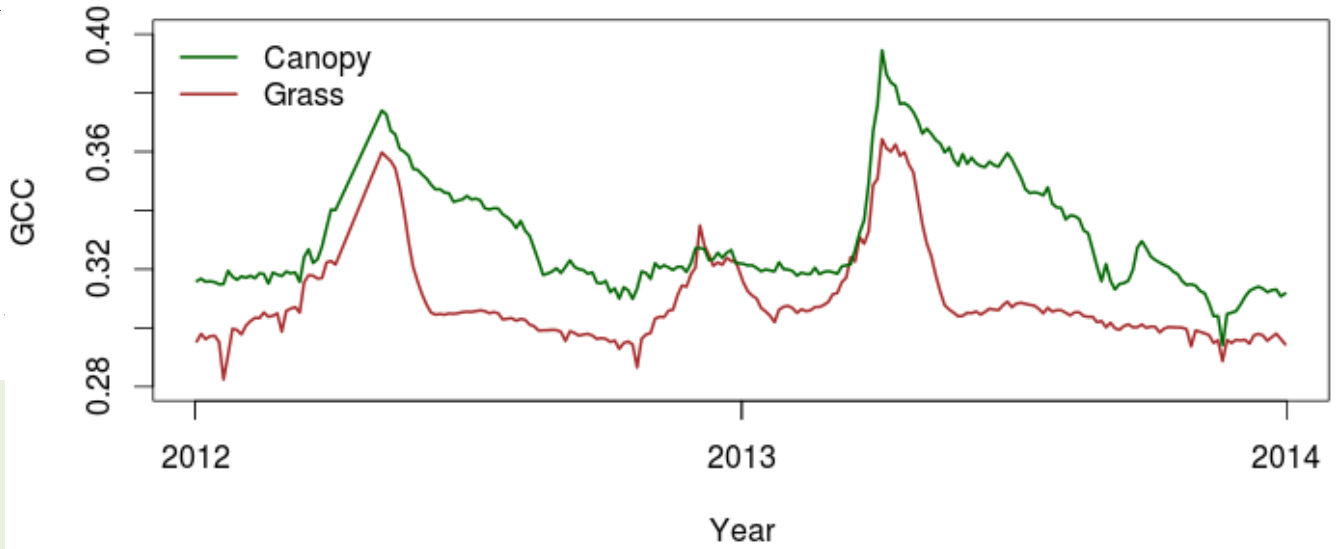


Images from Pheno-cam network

Tree canopy greenness



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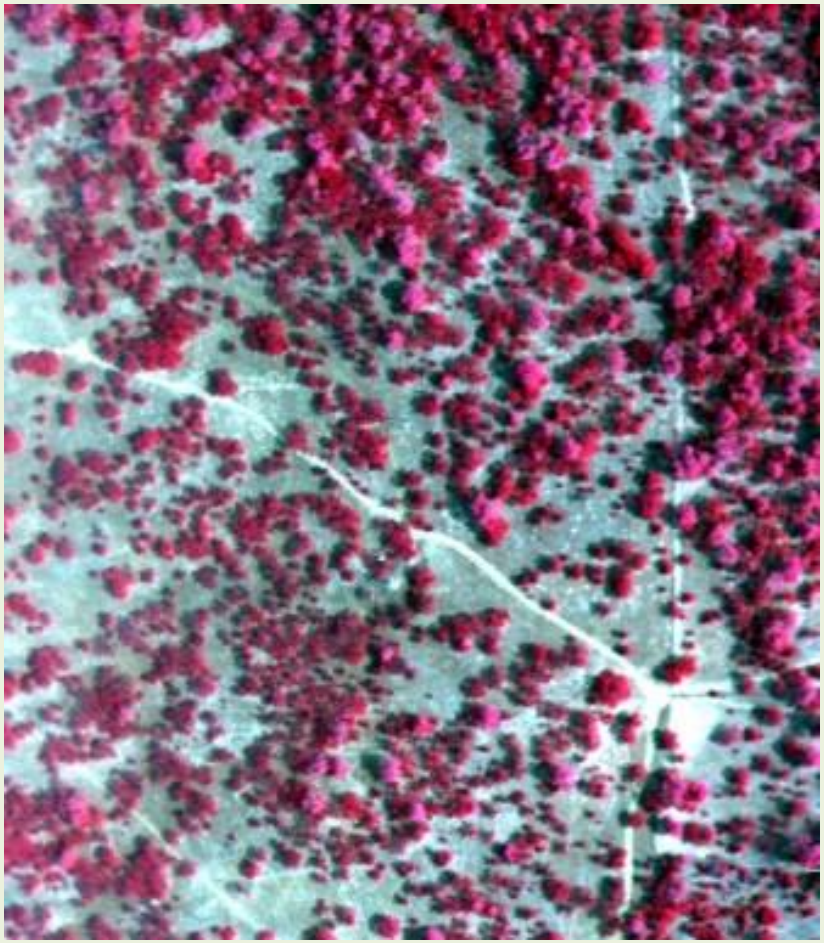
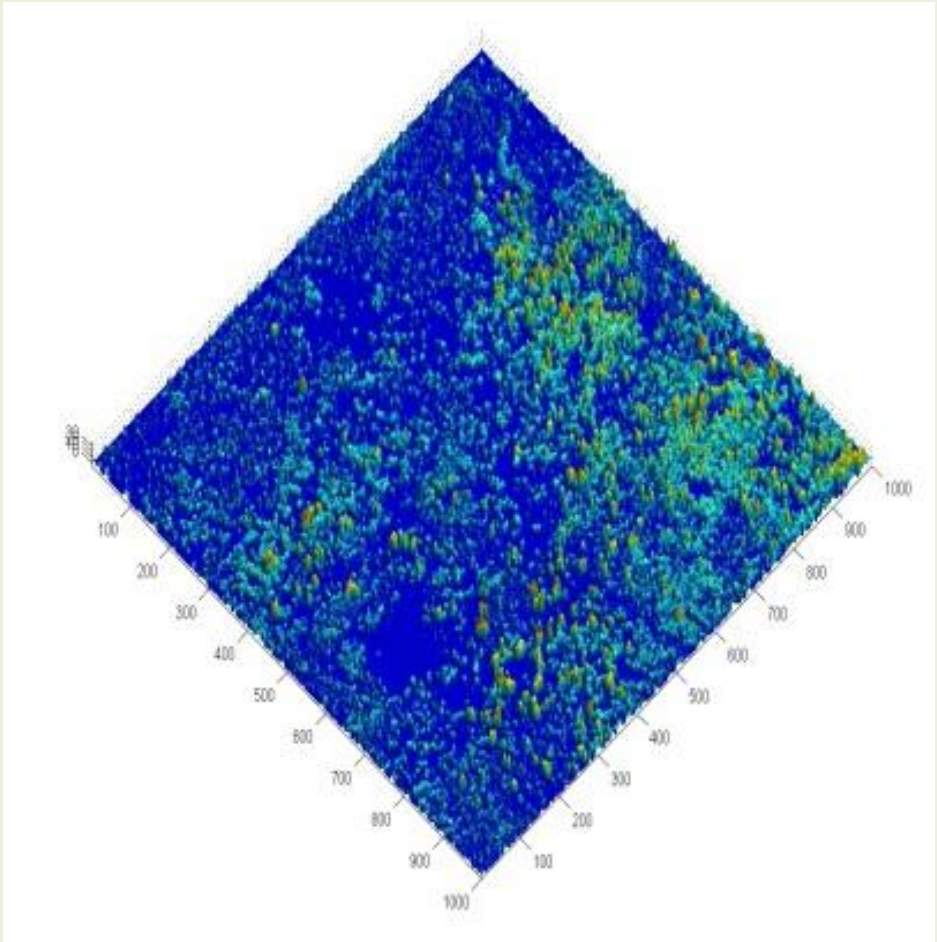
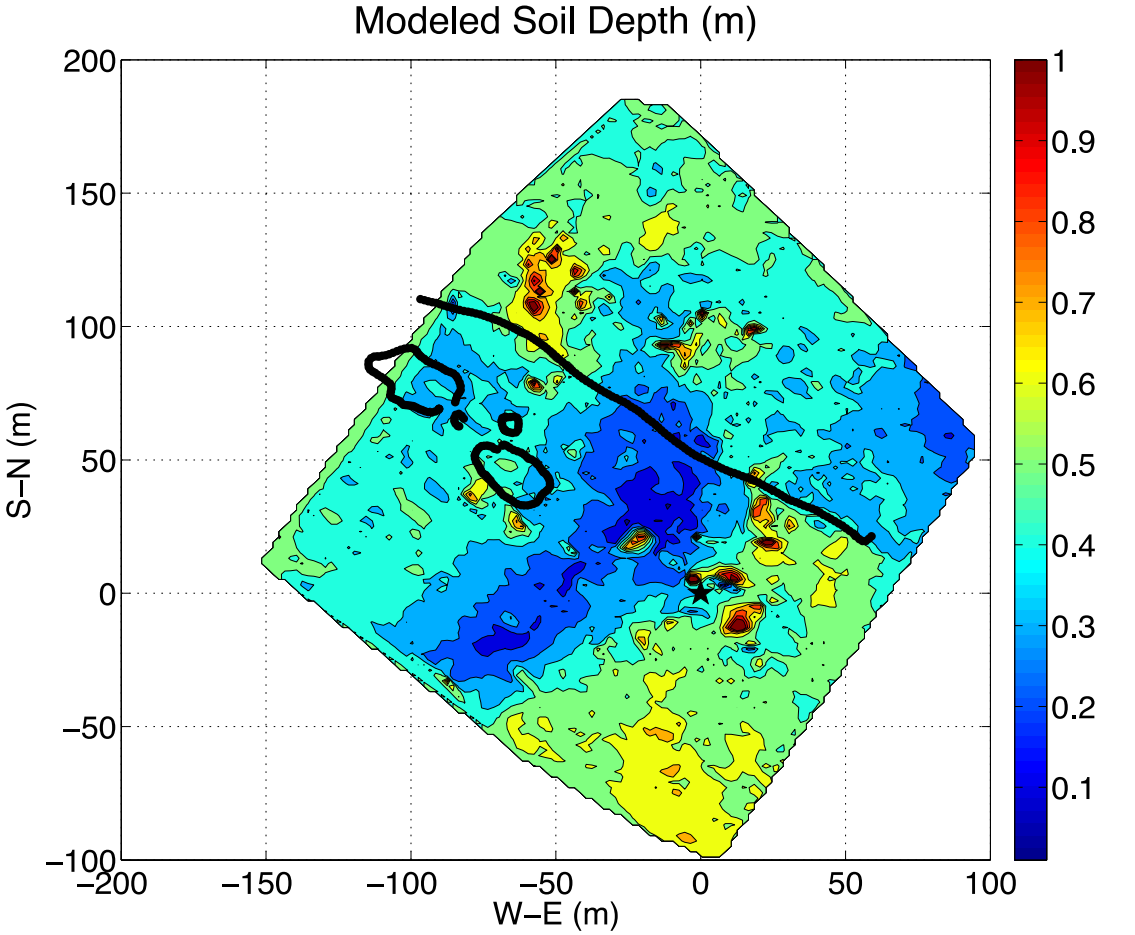
From LIDAR image to forest structure

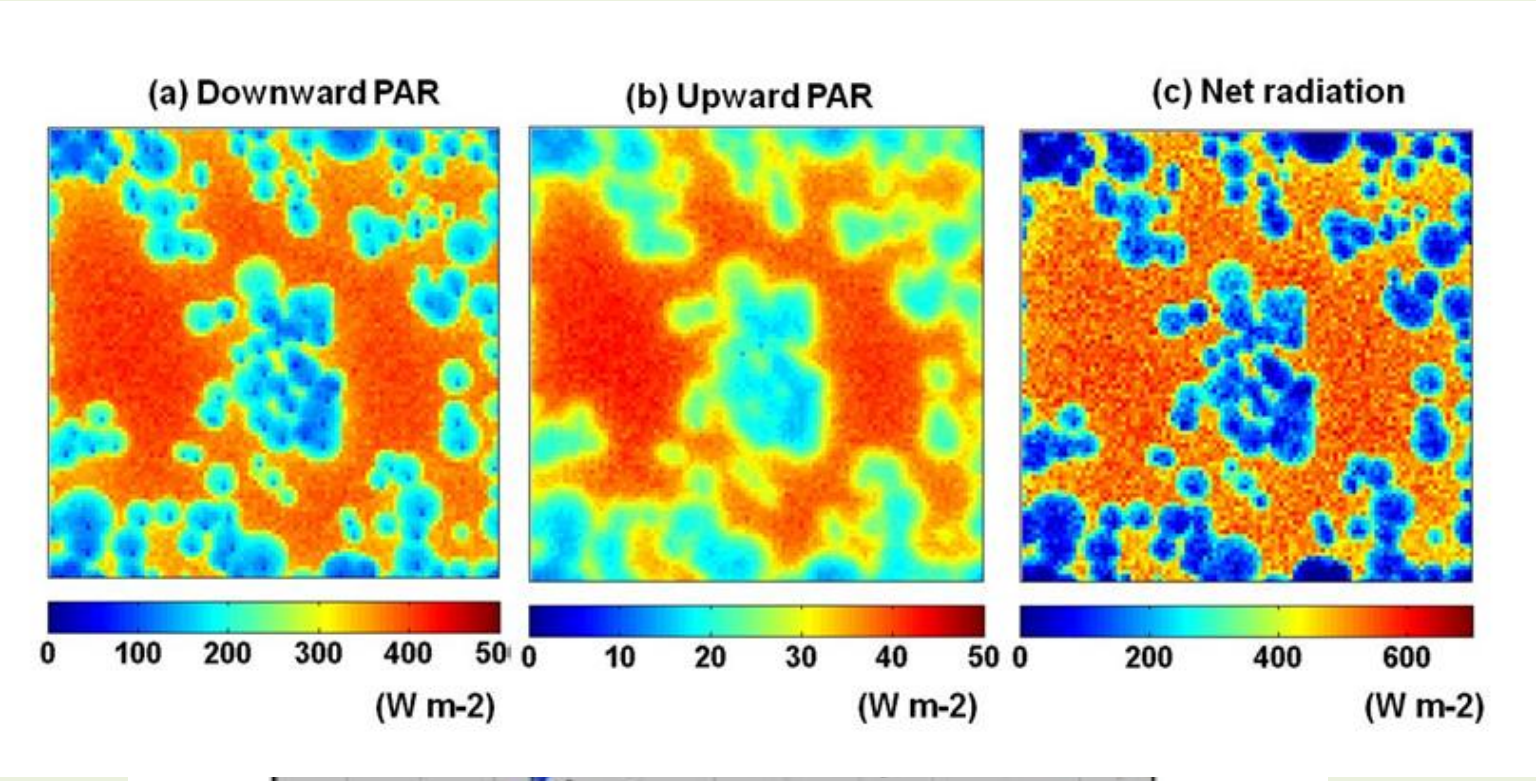




Electromagnetic Induction (EMI) Survey of Soil Depth



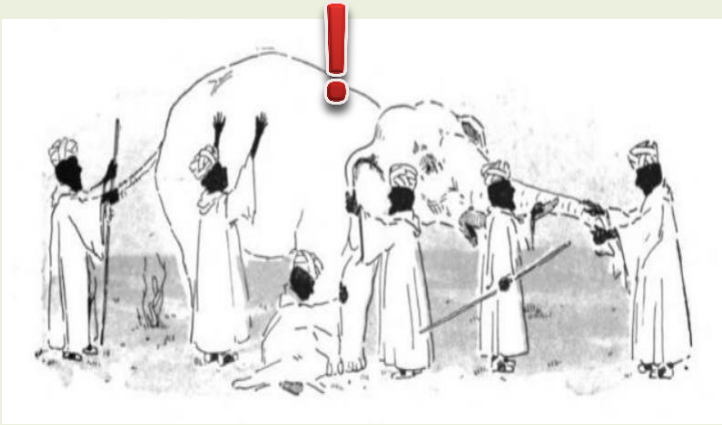
From field data to model integration



What we learn so far…

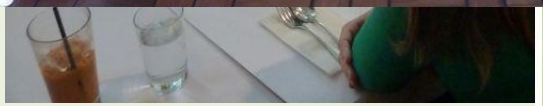
- **Different types of data to be shared:**
  - **time series**
  - **Snapshot/experiment-based data**
  - **spatial data**
  - **images…**

- **Balance between a-state-of-art and ongoing progress**
  - **Clean data set**
  - **Gapfilling**
  - **NEE partitioning**
  - **BADM variables**



- **Work together as a team**
  - **Set up and use the same language**
  - **Share algorithms and codes**
  - **keep up two-way communications**

Thank you!



Biometeorology

Environmental Science, Policy and Management